LISTING OF CLAIMS

1. (Original) An optical-wireless hybrid transmission system in which a central office has an optical transmitter and an optical receiver, said optical transmitter transmits an optical carrier signal to a base station via an optical transmission line, said base station receives an RF signal (frequency: f_{RF}) that is modulated according to transmit-data, optically modulates said optical carrier signal according to the received RF signal, and transmits a resulting modulated optical signal to said central office via an optical transmission line, and said optical receiver receives and demodulates the modulated optical signal and reproduces said transmit-data, the system characterized in:

that said optical transmitter comprises:

a first single-mode optical source which outputs a first single-mode optical signal (center frequency: f_{C1});

a second single-mode optical source which outputs a second single-mode optical signal (center frequency: f_{C2});

a third single-mode optical source which outputs a third single-mode optical signal (center frequency: f_{C3}); and

a polarization-coupling part which orthogonal-polarization-couples said second single-mode optical signal with said third single-mode optical signal while adjusting polarization directions and optical powers of two waves so as to make the polarization directions orthogonal and the optical powers identical, and outputs a resulting polarization-coupled optical signal, in which

the center frequencies f_{C1}, f_{C2}, and f_{C3} of said first, second, and third single-mode optical signals are controlled so as to satisfy

$$|f_{C1} - f_{C2}| = f_{RF} \pm f_{IF1}$$
$$|f_{C1} - f_{C3}| = f_{RF} \pm f_{IF2}$$

where f_{RF} is a frequency of said RF signal and f_{IF1} and f_{IF2} are prescribed intermediate frequencies; and

said first single-mode optical signal is transmitted to said base station as said optical carrier signal and said polarization-coupled optical signal is output to said optical receiver; and

that said optical receiver comprises:

an optical coupler which couples the modulated optical signal transmitted from said base station with said polarization-coupled optical signal output from said optical transmitter;

a photodetector which photodetects a coupled optical signal output from said optical coupler, and thereby outputs an electrical signal having the intermediate frequencies f_{IF1} and f_{IF2};

an electrical demodulator which demodulates the electrical signal having the intermediate frequencies f_{IF1} and f_{IF2} and output from said photodetector; and

a low-pass filter which filters an output signal of said electrical demodulator and thereby outputs said transmit-data.

2. (Original) An optical-wireless hybrid transmission system in which a central office has an optical transmitter and an optical receiver, said optical transmitter transmits an optical carrier signal to a base station via an optical transmission line, said base station receives an RF signal (frequency: f_{RF}) that is modulated according to transmit-data, optically modulates said optical carrier signal according to the received RF signal, and transmits a resulting modulated optical signal to said central office via an optical transmission line, and said optical receiver receives and demodulates the modulated optical signal and reproduces said transmit-data, the system characterized in:

that said optical transmitter comprises:

a first single-mode optical source which outputs a first single-mode optical signal (center frequency: f_{C1});

a second single-mode optical source which outputs a second single-mode optical signal (center frequency: f_{C2});

a third single-mode optical source which outputs a third single-mode optical signal (center frequency: f_{C3}); and

a polarization-coupling part which orthogonal-polarization-couples said second single-mode optical signal with said third single-mode optical signal while adjusting polarization directions and optical powers of two waves so as to make the polarization directions orthogonal and the optical powers identical, and outputs a resulting polarization-coupled optical signal, in which:

the center frequencies f_{C1}, f_{C2}, and f_{C3} of said first, second, and third single-mode optical signals are controlled so as to satisfy

$$|f_{C1} - f_{C2}| = f_{RF} \pm f_{IF1}$$
$$|f_{C1} - f_{C3}| = f_{RF} \pm f_{IF2}$$

where f_{RF} is a frequency of said RF signal and f_{IF1} and f_{IF2} are prescribed intermediate frequencies; and

said polarization-coupled optical signal is transmitted to said base station as said optical carrier signal and said first single-mode optical signal is output to said optical receiver; and

that said optical receiver comprises:

an optical coupler which couples the modulated optical signal transmitted from said base station with said first single-mode optical signal output from said optical transmitter;

a photodetector which photodetects a coupled optical signal that is output from said optical coupler, and thereby outputs an electrical signal having the intermediate frequencies f_{IF1} and f_{IF2};

an electrical demodulator which demodulates the electrical signal having the intermediate frequencies f_{IF1} and f_{IF2} and output from said photodetector; and

a low-pass filter which filters an output signal of said electrical demodulator and thereby outputs said transmit-data.

3. (Original) The optical-wireless hybrid transmission system according to claim 1 or 2, characterized in that said optical receiver comprises a filter, a first electrical demodulator and a second electrical demodulator, and a combiner in place of said electrical demodulator and said low-pass filter, the filter separating from each other an electrical signal having the intermediate frequency f_{IF1} and an electrical signal having the intermediate frequency f_{IF2} output from said photodetector, the first and second electrical demodulator demodulating the electrical signal having the intermediate frequency f_{IF1} and the electrical signal having the intermediate frequency f_{IF2}, respectively, that are output from said filter, the combiner combining an output signal of said first electrical demodulator with an output signal of said second electrical demodulator and thereby outputs said transmit-data.

4. (Original) The optical-wireless hybrid transmission system according to claim 1 or 2, characterized in that said optical receiver comprises a filter, a first electrical demodulator and a second electrical demodulator, and a delay-controllable combiner in place of said electrical demodulator and said low-pass filter, the filter separating from each other an electrical signal having the intermediate frequency f_{IF1} and an electrical signal having the intermediate frequency f_{IF2} output from said photodetector, the first and second electrical demodulator demodulating the electrical signal having the intermediate frequency f_{IF1} and the electrical signal having the intermediate frequency f_{IF2}, respectively, that are output from said filter, the delay-controllable combiner combining an output signal of said first electrical demodulator with an output

signal of said second electrical demodulator while equalizing their phases, and thereby outputs said transmit-data.

5. (Original) The optical-wireless hybrid transmission system according to claim 1, characterized by further comprising

a plurality of base stations, and a plurality of optical receivers in said central office, the optical receivers receiving modulated optical signals transmitted from the plurality of base stations, respectively, wherein said optical transmitter further comprises:

a first optical splitter which splits said first single-mode optical signal into a plurality of optical signals and transmits the split optical signals to said plurality of base stations as optical carrier signals, respectively; and

a second optical splitter which splits said polarization-coupled optical signal into a plurality of optical signals and outputs the split optical signals to said plurality of optical receivers, respectively.

6. (Original) The optical-wireless hybrid transmission system according to claim 2, characterized by further comprising

a plurality of base stations, and a plurality of optical receivers in said central office, the plurality of optical receivers receiving modulated optical signals transmitted from said plurality of base stations, respectively, wherein said optical transmitter further comprises:

a first optical splitter which splits said polarization-coupled optical signal into a plurality of optical signals and transmits the split optical signals to said plurality of base stations as optical carrier signals, respectively; and

a second optical splitter which splits said first single-mode optical signal into a plurality of optical signals and outputs the split optical signals to said plurality of optical receivers, respectively.

7. (Original) The optical-wireless hybrid transmission system according to claim 5, characterized by further comprising

an output-power-controllable optical splitter in place of said first optical splitter, being capable of individually setting optical powers of said optical carrier signals to be transmitted respectively to said plurality of base stations.

8. (Original) The optical-wireless hybrid transmission system according to claim 5, characterized by further comprising

an output-power-controllable optical splitter in place of said second optical splitter, being capable of individually setting optical powers of said polarization-coupled optical signals to be output respectively to said plurality of optical receivers.

9. (Original) The optical-wireless hybrid transmission system according to claim 5, characterized by further comprising:

an output-power-controllable optical splitter in place of said first optical splitter, being capable of individually setting optical powers of said optical carrier signals to be transmitted respectively to said plurality of base stations; and

an output-power-controllable optical splitter in place of said second optical splitter, being capable of individually setting optical powers of said

polarization-coupled optical signals to be output to said plurality of optical receivers, respectively.

10. (Original) The optical-wireless hybrid transmission system according to claim 6, characterized by comprising

an output-power-controllable optical splitter in place of said first optical splitter, being capable of individually setting optical powers of said optical carrier signals to be transmitted to said plurality of base stations, respectively.

11. (Original) The optical-wireless hybrid transmission system according to claim 6, characterized by comprising

an output-power-controllable optical splitter in place of said second optical splitter, being capable of individually setting optical powers of said first single-mode optical signals to be output to said plurality of optical receivers, respectively.

12. (Original) The optical-wireless hybrid transmission system according to claim 6, characterized by comprising:

an output-power-controllable optical splitter in place of said first optical splitter, being capable of individually setting optical powers of said optical carrier signals to be transmitted to said plurality of base stations, respectively; and

an output-power-controllable optical splitter in place of said second optical splitter, being capable of individually setting optical powers of said first single-mode optical signals to be output to said plurality of optical receivers, respectively.

13. (Original) The optical-wireless hybrid transmission system according to any one of claims 7 to 12, characterized in that

said output-power-controllable optical splitter/splitters of said optical transmitter sets/set said optical powers of the split optical signals so that an signal power of said electrical signal having the intermediate frequencies f_{IF1} and f_{IF2} and output from the photodetector of said optical receiver is made constant irrespective of an optical power of said optical signal received from said base station.

14. (Original) The optical-wireless hybrid transmission system according to any one of claims 7 to 12, characterized in that

said output-power-controllable optical splitter/splitters of said optical transmitter sets/set said optical powers of the split optical signals so that signal powers of the electrical signals having the intermediate frequencies f_{IF1} and f_{IF2} and output from the photodetectors of said optical receivers are made uniform for all of said optical receivers.

15. (Original) The optical-wireless hybrid transmission system according to any one of claims 7 to 12, characterized in that

said output-power-controllable optical splitter/splitters of said optical transmitter set said optical powers of the split optical signals so that signal-to-noise ratios of the electrical signals having the intermediate frequencies f_{IF1} and f_{IF2} and output from the photodetectors of said optical receivers are made uniform for all of said optical receivers.

16. (Original) An optical-wireless hybrid transmission method in which a central office has an optical transmitter and an optical receiver, said optical transmitter transmits an optical carrier signal to a base station via an optical transmission line, said base station receives an RF signal (frequency: f_{RF}) that is modulated according to transmit-data, optically modulates said optical carrier signal according to the received RF signal, and transmits a resulting modulated optical signal to said central office via an optical transmission line, and said optical receiver receives and demodulates the modulated optical signal and reproduces said transmit-data, characterized by comprising the steps of:

transmitting, by said optical transmitter, a first single-mode optical signal (center frequency: f_{C1}) to said base station as said optical carrier signal;

outputting, by said optical transmitter, a polarization-coupled optical signal from said optical transmitter to said optical receiver, the polarization coupled optical signal being obtained by orthogonal-polarization-coupling a second single-mode optical signal (center frequency: f_{C2}) with a third single-mode optical signal (center frequency: f_{C3}) so as to give two waves orthogonal polarization directions and a same optical power;

controlling, by said optical transmitter, the center frequencies f_{C1}, f_{C2}, and f_{C3} of said first, second, and third single-mode optical signals so that they satisfy

$$|f_{C1}-f_{C2}|=f_{RF}\pm f_{IF1}$$
$$|f_{C1}-f_{C3}|=f_{RF}\pm f_{IF2}$$

where f_{RF} is a frequency of said RF signal and f_{IF1} and f_{IF2} are prescribed intermediate frequencies;

coupling, by said optical receiver, the modulated optical signal transmitted from said base station with said polarization-coupled optical signal output from said optical transmitter;

demodulating, by said optical receiver, an electrical signal having the intermediate frequencies f_{IF1} and f_{IF2} that is obtained by photodetecting a resulting coupled optical signal; and

generating, by said optical receiver, said transmit-data by filtering a resulting output signal.

17. (Original) An optical-wireless hybrid transmission method in which a central office has an optical transmitter and an optical receiver, said optical transmitter transmits an optical carrier signal to a base station via an optical transmission line, said base station receives an RF signal (frequency: f_{RF}) that is modulated according to transmit-data, optically modulates said optical carrier signal according to the received RF signal, and transmits a resulting modulated optical signal to said central office via an optical transmission line, and said optical receiver receives and demodulates the modulated optical signal and reproduces said transmit-data, characterized by comprising the steps of:

outputting, by said optical transmitter, a first single-mode optical signal (center frequency: f_{C1}) to said optical receiver;

generating, by said optical transmitter, a polarization-coupled optical signal by orthogonal-polarization-coupling a second single-mode optical signal (center frequency: f_{C2}) with a third single-mode optical signal (center frequency: f_{C3}) so as to give two waves orthogonal polarization directions and a same optical power;

transmitting, by said optical transmitter, the generated polarization-coupled optical signal to said base station as said optical carrier signal; and

controlling, by said optical transmitter, the center frequencies f_{C1}, f_{C2}, and f_{C3} of said first, second, and third single-mode optical signals so that they satisfy

$$|f_{C1}-f_{C2}| = f_{RF} \pm f_{IF1}$$
$$|f_{C1}-f_{C3}| = f_{RF} \pm f_{IF2}$$

where f_{RF} is a frequency of said RF signal and f_{IF1} and f_{IF2} are prescribed intermediate frequencies;

coupling, by said optical receiver, the modulated optical signal transmitted from said base station with said optical signal output from said optical transmitter;

demodulating, by said optical receiver, an electrical signal having the intermediate frequencies f_{IF1} and f_{IF2} that is obtained by photodetecting a resulting coupled optical signal; and

generating, by said optical receiver, said transmit-data by filtering a resulting output signal.

18. (Original) The optical-wireless hybrid transmission method according to claim 16 or 17, characterized by comprising the steps of:

separating, by said optical receiver, electrical signals having the intermediate frequencies f_{IF1} and f_{IF2} from each other;

individually demodulating, by said optical receiver, the electrical signal having the intermediate frequency f_{IF1} and the electrical signal having the intermediate frequency $f_{IF2;}$ and

generating, by said optical receiver; said transmit-data by combining resulting output signals with each other.

19. (Original) The optical-wireless hybrid transmission method according to claim 16 or 17, characterized by further comprising the steps of:

separating, by said optical receiver, electrical signals having the intermediate frequencies f_{IF1} and f_{IF2} from each other;

individually demodulating, by said optical receiver, the electrical signal having the intermediate frequency f_{IF1} and the electrical signal having the intermediate frequency f_{IF2}; and

generating, by said optical receiver, said transmit-data by combining resulting output signals with each other after equalizing their phases.